

# CLAIMS

1. A compound represented by formula (I)



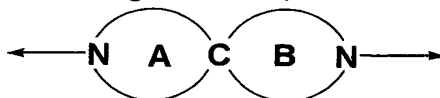
wherein D and G are each independently a cyclic group which may have a substituent(s) or alkyl which may have a substituent(s),

W and Y are each independently a bond or a spacer of which main chain has an atom number of 1-4,

ringA and ringB are each independently a heterocyclic ring which may have a substituent(s), containing at least one carbon atom and one nitrogen atom and the ringA and ringB share one spiro carbon atom,

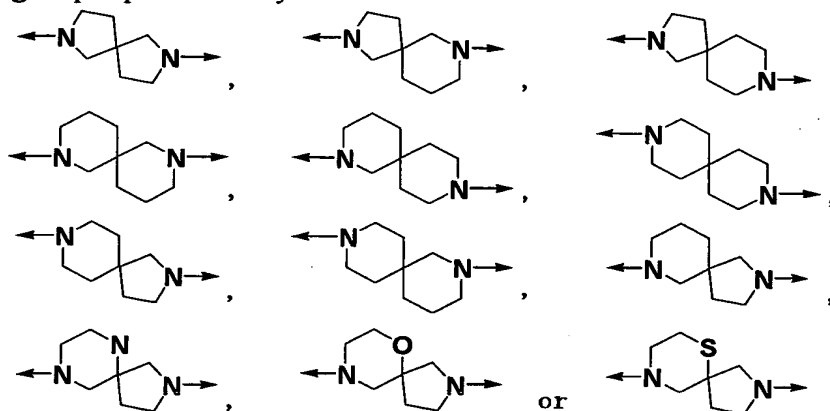
a salt thereof, an N-oxide thereof or a solvate thereof, or a prodrug thereof.

2. The compound according to claim 1, wherein the group represented by



wherein left-pointing arrow binds to W, right-pointing arrow binds to Y, and other symbols have the same meanings as in claim 1, which may have a substituent(s) in formula (I)

is a group represented by



wherein left-pointing arrow binds to W, and right-pointing arrow binds to Y, which may have a substituent(s).

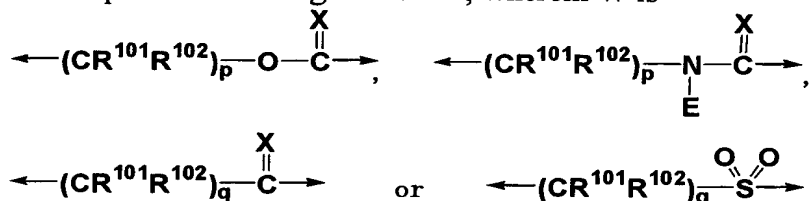
3. The compound according to claim 1, wherein D and/or G is (1) C3-10 mono- or bi-carbocyclic ring or (2) 3-10 membered mono-, or bi-cyclic hetero ring containing 1 to 5

hetero atom(s) selected from oxygen atom(s), nitrogen atom(s) and/or sulfur atom(s) which may have a substituent(s).

4. The compound according to claim 3, wherein D and/or G is benzene which may have a substituent(s).

5. The compound according to claim 1, wherein W is a spacer of which main chain has an atom number of 1-4 containing a hydrogen-bond acceptor site.

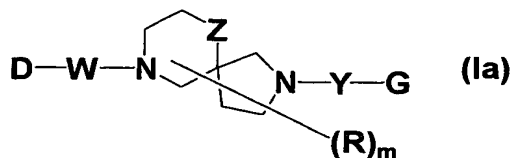
6. The compound according to claim 5, wherein W is



wherein X is an oxygen atom or a sulfur atom, E is a hydrogen atom(s) or a substituent(s), R<sup>101</sup> and R<sup>102</sup> are each independently a hydrogen atom(s) or a substituent(s), p is 0 or an integer of 1 to 2, q is 0 or an integer of 1 to 3, left-pointing arrow binds to D, and right-pointing arrow binds to ringA.

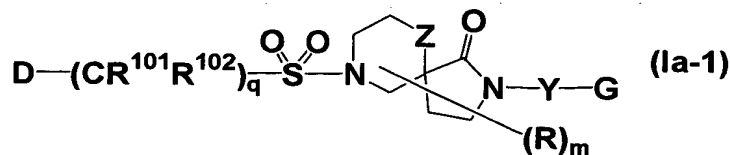
7. The compound according to claim 1, wherein Y is a bond or methylene.

8. The compound according to claim 1, wherein the compound is the compound represented by formula (Ia)



wherein R is/are a substituent(s), m is 0 or an integer of 1 to 6, Z is a carbon atom, a nitrogen atom, a sulfur atom or an oxygen atom, and the other symbols have the same meanings as in claim 1.

9. The compound according to claim 8, wherein the compound represented by formula (Ia-1)



wherein all symbols have the same meanings as in claims 1, 5, and 8, and  
wherein

- (1) *tert*-butyl 1,10-dioxo-7-(phenylsulfonyl)-2,7-diazaspiro[4.5]decane-2-carboxylate,
- (2) *tert*-butyl 10-(furan-3-yl)-1-oxo-7-(phenylsulfonyl)-2,7-diazaspiro[4.5]decane-2-carboxylate, and
- (3) 2-benzyl-3-(2-hydroxyethyl)-7-(phenylsulfonyl)-2,7-diazaspiro[4.5]decane-1,10-dione are excepted .

10. The compound according to claim 9, the compound is

- (1) 7-[(4-methylphenyl)sulfonyl]-2-phenyl-2,7-diazaspiro[4.5]decan-1-one,
- (2) 7-[(4-methoxyphenyl)sulfonyl]-2-phenyl-2,7-diazaspiro[4.5]decan-1-one,
- (3) 7-[(4-methylphenyl)sulfonyl]-2-(4-phenoxybenzyl)-2,7-diazaspiro[4.5]decan-1-one,
- (4) 4-[(1-oxo-2-phenyl-2,7-diazaspiro[4.5]-7-decyl)sulfonyl]benzonitrile,
- (5) 2-(4-fluorophenyl)-7-{[2-(trifluoromethoxy)phenyl]sulfonyl}-2,7-diazaspiro[4.5]decan-1-one,
- (6) 2-phenyl-7-{[2-(trifluoromethoxy)phenyl]sulfonyl}-2,7-diazaspiro[4.5]decan-1-one,
- (7) 7-{[5-methyl-2-(trifluoromethyl)furan-3-yl]sulfonyl}-2-phenyl-2,7-diazaspiro[4.5]decan-1-one,
- (8) 7-[(3-chlorobenzyl)sulfonyl]-2-(4-methoxyphenyl)-2,7-diazaspiro[4.5]decan-1-one,
- (9) 4-{[2-(4-chlorophenyl)-1-oxo-2,7-diazaspiro[4.5]-7-decyl]sulfonyl}benzonitrile,
- (10) 2-(4-chlorophenyl)-7-{[5-methyl-2-(trifluoromethyl)furan-3-yl]sulfonyl}-2,7-diazaspiro[4.5]decan-1-one,
- (11) 3-chloro-4-{[2-(4-chlorophenyl)-1-oxo-2,7-diazaspiro[4.5]-7-decyl]sulfonyl}benzonitrile,
- (12) 3-chloro-4-{[2-(4-chloro-2-fluorophenyl)-1-oxo-2,7-diazaspiro[4.5]-7-decyl]sulfonyl}benzonitrile,
- (13) 2-(4-chloro-2-fluorophenyl)-7-[(3,5-dimethylphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (14) 2-(4-chlorophenyl)-7-[(4-methoxyphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (15) 4-({1-oxo-2-[4-(trifluoromethoxy)phenyl]-2,7-diazaspiro[4.5]-7-decyl}sulfonyl)benzonitrile,

- (16) 7-[(4-methoxyphenyl)sulfonyl]-2-[4-(trifluoromethoxy)phenyl]-2,7-diazaspiro[4.5]decan-1-one,
- (17) 2-(4-chlorophenyl)-7-[(4-chlorophenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (18) 2-(4-chlorophenyl)-7-[(4-methylphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (19) 7-[(4-chlorophenyl)sulfonyl]-2-[4-(trifluoromethoxy)phenyl]-2,7-diazaspiro[4.5]decan-1-one,
- (20) 7-[(4-methylphenyl)sulfonyl]-2-[4-(trifluoromethoxy)phenyl]-2,7-diazaspiro[4.5]decan-1-one,
- (21) 2-(4-chlorophenyl)-9-[(4-methoxyphenyl)sulfonyl]-6-oxa-2,9-diazaspiro[4.5]decan-1-one,
- (22) 9-[(4-chlorophenyl)sulfonyl]-2-[4-(trifluoromethoxy)phenyl]-6-oxa-2,9-diazaspiro[4.5]decan-1-one,
- (23) 9-[(4-methylphenyl)sulfonyl]-2-[4-(trifluoromethoxy)phenyl]-6-oxa-2,9-diazaspiro[4.5]decan-1-one,
- (24) 2-(4-chlorophenyl)-9-[(4-methylphenyl)sulfonyl]-6-oxa-2,9-diazaspiro[4.5]decan-1-one,
- (25) 2-[4-(difluoromethoxy)phenyl]-7-[(4-methoxyphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (26) 2-(2,2-difluoro-1,3-benzodioxol-5-yl)-7-[(4-methoxyphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one,
- (27) 7-[(4-methoxyphenyl)sulfonyl]-2-(pyridin-4-yl)-2,7-diazaspiro[4.5]decan-1-one,  
or
- (28) 2-(5-chloropyridin-2-yl)-7-[(4-methoxyphenyl)sulfonyl]-2,7-diazaspiro[4.5]decan-1-one.

11. A pharmaceutical composition comprising the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof.

12. The pharmaceutical composition according to claim 11, wherein the pharmaceutical composition is a preventive and/or therapeutic agent for mitochondrial benzodiazepine receptor mediated disease.

13. The pharmaceutical composition according to claim 12, wherein the mitochondrial benzodiazepine receptor mediated disease is a disease caused by stress.

14. The pharmaceutical composition according to claim 13, wherein the disease caused by stress is a central nervous system disease caused by stress, a respiratory system disease caused by stress and/or a digestive system disease caused by stress.

15. The pharmaceutical composition according to claim 14, wherein the central nervous system disease caused by stress is anxiety-related disease, sleep disorder, depression and/or epilepsy, a respiratory system disease caused by stress is asthma, a digestive system disease caused by stress is irritable bowel syndrome.

16. A pharmaceutical composition combining of the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof and one or two or more kinds selected from antianxiety drugs, antidepressant drugs, antiparkinson drugs, therapeutic drugs for schizophrenia, antiepileptic drugs, therapeutic drugs for asthma, therapeutic drugs for peptic ulcer, adjustive drugs for gastrointestinal function, antidiarrheals, evacuants, antihypertensive drugs, antiarrhythmic drugs, inotropic drugs and therapeutic drugs for urination disorder.

17. A method for prevention and/or treatment for a mitochondrial benzodiazepine receptor mediated disease in mammals, which comprises administering an effective amount of the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide, a solvate or a prodrug thereof to the mammals.

18. Use of the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof for preparing a preventive and/or therapeutic agent for a mitochondrial benzodiazepine receptor mediated disease.